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Effect of virgin coconut oil on total cholesterol levels in patients with hypercholesterolemia: A quasi-experimental study

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ABSTRACT

Introduction: Hypercholesterolemia is closely associated with increased cardiovascular risk and is influenced by unhealthy dietary patterns, aging, obesity, and limited physical activity. Virgin coconut oil (VCO) has been widely introduced as a complementary nutritional therapy because it contains medium-chain fatty acids, polyphenols, and antioxidant compounds that may improve lipid metabolism. Nevertheless, findings regarding its effectiveness in reducing cholesterol levels remain inconsistent. This study aimed to analyze the effect of VCO administration on total cholesterol levels among patients with hypercholesterolemia in Padukuhan Tegalsari, Pakembinangun, Yogyakarta.

Research Methodology: This study employed a quasi-experimental pre–post test design with a control group approach. A total of 66 respondents with total cholesterol levels >180 mg/dL were selected using purposive sampling and were equally allocated to the intervention (n=33) and control (n=33) groups. The intervention group received VCO at a dose of 2 × 20 mL daily for 14 consecutive days, while the control group received no intervention. Total cholesterol levels were measured using peripheral blood samples before and after the intervention period. Data were analyzed using the Mann–Whitney test with a significance level of 0.05.

Results: Most respondents were elderly (89.4%) and female (59.1%). Risk-related behaviours remained common, including daily consumption of fried foods (46.96%) and low physical activity (<3 times/week; 46.96%). Before treatment, both groups showed comparable cholesterol levels (p=0.326), with most respondents classified in the very high cholesterol category. After the intervention, the proportion of respondents in the very high cholesterol category increased from 63.8% to 84.8% in the intervention group. Statistical analysis demonstrated no significant difference in total cholesterol levels between the intervention and control groups after treatment (p=0.200).

Conclusion: Administration of VCO at a dose of 2 × 20 mL for 14 days did not significantly reduce total cholesterol levels in patients with hypercholesterolemia. Lipid profile management requires a comprehensive approach that takes various risk factors into account. The limitations of this study include the relatively short duration of the intervention (14 days) and the fact that a complete lipid profile assessment was not carried out. Future studies are recommended to employ a longer intervention period and to evaluate lipid profiles comprehensively, including HDL, LDL and total cholesterol.

Keywords: cholesterol; hypercholesterolemia; lipid metabolism; virgin coconut oil.

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INTRODUCTION

Advances in food technology and rising incomes have led to changes in dietary patterns, with people increasingly consuming fast food that is typically low in fibre but very high in calories and fat. Consumption of high-calorie, high-fat, and low-fibre foods triggers hypercholesterolemia. Hypercholesterolemia is a condition characterised by elevated triglycerides, accompanied by elevated LDL-C and low HDL-C (Juliani et al., 2026). Factors associated with high blood cholesterol levels include genetic factors, consumption of unhealthy foods, lack of physical activity, smoking or exposure to secondhand smoke, and obesity (Al-Saleh et al., 2026). Elevated total cholesterol levels significantly increase the risk of death due to cardiovascular disease (HR 1.52; 95% CI 1.13–2.06) (Bassole Epse Brou et al., 2026).

Appropriate management of hypercholesterolemia is necessary to reduce the risk of cardiovascular complications. Management of hypercholesterolemia includes lifestyle modifications, such as dietary management, regular physical activity, weight control, smoking cessation, statin therapy for high-risk individuals, and periodic lipid profile monitoring every 4–12 weeks (Zheng et al., 2024). One additional non-pharmacological therapy for lowering cholesterol is Virgin Coconut Oil (VCO) (Setyawati et al., 2023). Research findings indicate that reducing saturated fat (SFA) intake and replacing it with polyunsaturated fats (PUFA) can lower LDL by 13–16%, thereby reducing the risk of coronary heart disease by 30%; this effect is comparable to the benefits of statin therapy (Giles, 2024). Nevertheless, VCO, which consists of 90% saturated fatty acids (SFA), has been widely promoted as a complementary therapy to help manage obesity, diabetes, and lipid profile disorders (Duarte et al., 2022). VCO is a "functional food oil," meaning it has potential health benefits due to its bioactive compounds. VCO possesses unique characteristics that distinguish it from refined coconut oil; its extraction method, which avoids the use of chemicals, ensures that bioactive compounds remain intact (Rohman et al., 2021).

In vivo study results indicate that administering VCO to experimental animals for 5 weeks resulted in a significant decrease in total cholesterol (TC) and triglyceride (TG) levels, while LDL and HDL levels increased significantly compared to the control group ($P < 0.05$). There was a beneficial effect on the cardiovascular risk index (Kosmas et al., 2023). VCO contains minor compounds such as medium-chain fatty acids (MCFAs) and tocopherols, most of which are preserved during the extraction process; these MCFAs are metabolised more rapidly than long-chain fatty acids and are therefore rarely stored as saturated fat in the body (Yan et al., 2025). Additionally, the content of lauric acid and bioactive compounds, such as phenolics and vitamin E, can improve the balance of lipoproteins in the blood, leading to an increase in HDL and a decrease in LDL and triglycerides (Araújo Bidô et al., 2026).

Results from an RCT study showed that the intervention group, which received 1000 mg of VCO daily for 8 weeks, demonstrated a significant increase in HDL ($P < 0.001$; CI 2.43–3.08 mg/dL). Due to its content of medium-chain fatty acids (MCFAs), particularly lauric acid (C12), MCFAs enter the portal vein directly and travel to the liver, allowing fats to be easily oxidized and not stored in the body. MCFAs also reduce the activity of HMG-CoA reductase, the primary enzyme involved in cholesterol synthesis, thereby lowering cholesterol production and improving total cholesterol and LDL levels. VCO also increases lipoprotein lipase (LPL) activity, thereby lowering triglycerides and reducing VLDL formation, which, in turn, lowers LDL. VCO increases ApoA1 activity, thereby increasing HDL production in the liver. VCO is rich in antioxidants, including polyphenols and natural vitamin E, which help reduce oxidised LDL and thereby prevent the formation of atherosclerotic plaques. However, the results of another study also showed a different picture, in that the administration of VCO did not result in any significant change in triglyceride levels. Similarly, the results of a meta-analysis on VCO's effect on lipid profiles also indicate that VCO consumption does not significantly reduce LDL and triglycerides, but does result in a small increase in HDL.

A survey conducted among the elderly living in RW 13, Tegalsari Hamlet, Pakembinangun, Pakem, Sleman, found that 14 out of 29 individuals who underwent cholesterol testing at the Tegalsari Posbindu had elevated cholesterol levels (>180 mg/dL). VCO has been widely used as a complementary therapy believed to help improve blood lipid profiles. Various studies have evaluated the effectiveness of VCO on lipid profiles, but the results obtained still show mixed findings. Some studies report improvements in lipid profiles following VCO administration, whilst others have found no significant effect. Furthermore, VCO administration has never been implemented by Posyandu Lansia volunteers in Tegalsari hamlet for individuals with hypercholesterolaemia. Although numerous studies have examined the use of virgin coconut oil (VCO) to lower blood lipid levels, this intervention has not yet been implemented by senior health volunteers at the senior health post in Tegalsari Village for residents with hypercholesterolemia. This study was conducted to determine the effect of VCO administration on total blood cholesterol levels in adults with hypercholesterolemia in Padukuhan Tegalsari, Pakembinangun, Yogyakarta.

RESEARCH METHODOLOGY

Research design

This study employed a quasi-experimental design using a pre-post test with a control group. This design aimed to compare changes in total cholesterol levels before (pre) and after (post) the intervention among participants in the control and intervention groups.

Study Setting and Population

This study was conducted in Padukuhan Tegalsari, RW 13, Pakembinangun, Yogyakarta, from October 3–17, 2021. The study population consisted of all members of the Posbindu in that area.

Sample and Sampling Technique

The sampling technique used was purposive sampling with the following inclusion criteria: Total cholesterol level >180 mg/dL, not currently undergoing pharmacological or non-pharmacological therapy to lower lipid profile.

In a conscious state (compos mentis) and willing to participate

The sample size in this study was 66 respondents, divided into two groups: 33 respondents in the control group and 33 respondents in the intervention group. To ensure fairness, group allocation was performed using systematic random sampling.

Intervention

Participants in the intervention group were given sterile Virgin Coconut Oil (VCO) at a dose of 2 × 20 ml per day (morning and evening) for 14 consecutive days, while participants in the control group received no intervention.

Data Collection Instruments

The instruments used in this study included a test for total cholesterol levels using peripheral blood samples and an observation sheet to monitor the respondents' adherence to VCO consumption.

Data Collection Procedure

Data collection was conducted in two stages: a pre-test and a post-test. Total cholesterol levels were measured before the intervention and after 14 days of intervention. During the intervention period, participants in the intervention group were asked to consume VCO regularly and record their daily consumption on the provided observation sheets. The researchers used these records to monitor the respondents' adherence to the intervention. The researchers conducted a second total cholesterol measurement (post-test) on day 15 as the final assessment.

Data Analysis

The researchers analysed the data using the nonparametric Mann-Whitney test to assess differences in mean total cholesterol levels between the control and intervention groups. The researchers processed the data using SPSS software with a significance level (α) of 0.05.

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of STIKes Bethesda Yogyakarta under number 158/KEPK.02.01/IX/2021 on September 15, 2021. The researchers explained the purpose of the study to all respondents, and all respondents provided informed consent to participate. In conducting the study, all researchers adhered to the ethical principles of anonymity, non-maleficence, beneficence, and justice.

RESULT

The results section presents the findings obtained from the analysis of respondent characteristics and the effect of Virgin Coconut Oil (VCO) administration on total cholesterol levels among patients with hypercholesterolemia in Padukuhan Tegalsari, Pakembinangun, Yogyakarta. Data analysis was conducted using the Mann–Whitney test to compare total cholesterol levels between the control and intervention groups before and after the intervention period. Table 1. Characteristics of Respondents with Hypercholesterolemia.

Table 1. Characteristics of Respondents (n=66)

Variable	Category	n	%
Age	26–35 years	2	3.0
	36–45 years	5	7.6
	46–55 years	16	24.2
	56–65 years	18	27.3
	>65 years	25	37.9
Gender	Male	27	40.9
	Female	39	59.1
Fried food consumption	Every day	31	46.9
	3 times/week	22	33.3
	<3 times/week	13	19.7
Physical activity	Every day	20	30.3
	3 times/week	15	22.7
	<3 times/week	31	46.9
Smoking habit	Yes	8	12.1
	No	58	87.9
Family history of hypercholesterolemia	Yes	11	16.7
	No	55	83.3

Most respondents were elderly individuals aged 55 years or older (65.2%) and female (59.1%). Nearly half of the respondents consumed fried foods daily and reported low physical activity, indicating lifestyle-related risk factors for elevated cholesterol. Table 2 Comparison of

Total Cholesterol Levels Between the Control and Intervention Groups Before and After Virgin Coconut Oil (VCO) Administration.

Table 2. Bivariate Analysis of Total Cholesterol Levels Using the Mann–Whitney Test

Variable	Control Group	Intervention Group	p-value
Pre-test: Very high cholesterol (>200 mg/dL), n (%)	19 (57.6)	21 (63.8)	0.326
Post-test: Very high cholesterol (>200 mg/dL), n (%)	28 (84.8)	24 (72.7)	0.200
Normal cholesterol after intervention, n (%)	0 (0.0)	2 (6.1)	0.200

The Mann–Whitney analysis showed no statistically significant difference in total cholesterol levels between the control and intervention groups before treatment ($p=0.326$), indicating comparable baseline conditions. After 14 days of intervention, the difference in total cholesterol levels between the two groups remained statistically non-significant ($p=0.200$). These findings indicate that administering VCO at 2 × 20 mL per day did not significantly reduce total cholesterol levels among respondents with hypercholesterolemia.

This study demonstrated that the majority of respondents with hypercholesterolemia were elderly women with lifestyle characteristics that potentially contributed to elevated cholesterol levels, including frequent fried food consumption and limited physical activity. Baseline analysis showed no statistically significant difference between the control and intervention groups, suggesting that both groups were comparable before treatment. Following the 14-day intervention period, respondents in both groups remained predominantly in the very high cholesterol category. Although a small proportion of respondents in the intervention group achieved normal cholesterol levels after treatment, the overall statistical analysis showed no significant reduction in cholesterol levels associated with VCO administration. The Mann–Whitney test confirmed that the observed differences between groups were not statistically significant. These findings suggest that short-term VCO administration alone may not be sufficient to improve cholesterol levels in patients with hypercholesterolemia. Other contributing factors, including age, dietary habits, and physical activity, may have exerted a stronger influence on lipid profiles during the intervention period. Comprehensive lifestyle modification remains essential in the management of hypercholesterolemia.

DISCUSSION

Table 1 shows that the majority of respondents with hypercholesterolemia did not have the condition due to familial factors but rather due to other factors, including age, gender, diet, and physical activity patterns. Most respondents were elderly (89.4%) and female (59.1%); this finding aligns with a study by Srivastava et al. (2023), which reported that the majority of respondents with hypercholesterolemia were in the elderly age group (52.9%) and were predominantly female (70.6%). Research findings by Husen et al. (2022) indicate a significant, positive, and strong correlation between age and cholesterol levels, such that as age increases, respondents' cholesterol levels also rise ($P < 0.001$; $r = 0.723$). This is supported by the findings of a study (Barbagallo et al., 2025), which examined postmenopausal women; the results showed that total cholesterol levels were 208.9 ± 38.9 mg/dL (elevated), HDL levels were 61.8 ± 14.3 mg/dL, and LDL levels were 125.5 ± 38.1 mg/dL (at the high threshold). The rise in cholesterol levels in both men and women begins at age 20; in men, this increase continues until age 50, whereas in women, it occurs after menopause (Gouni-Berthold & Laufs, 2024). Before menopause, estrogen enhances protein anabolism, increases HDL production, and reduces LDL concentration in the blood; this is what lowers women's risk of hypercholesterolemia compared to men (Maia et al., 2025). As age increases, the function of LDL receptors declines, leading to elevated LDL levels. LDL receptors act as inhibitors of cholesterol synthesis; decreased LDL receptor activity increases cholesterol synthesis, leading to elevated cholesterol levels (Huang et al., 2026).

The community of Padukuhan Tegalsari exhibits behaviours that could raise cholesterol levels, specifically, daily consumption of fried foods at 46.96%. This finding aligns with a study Ramos-Pardo et al. (2026), which showed that 72.3% of respondents with hypercholesterolemia had a habit of consuming fatty foods. The results of this study indicate that individuals who frequently consume fatty foods tend to experience elevated cholesterol levels. The composition of daily dietary intake significantly influences blood cholesterol levels; the study findings suggest that individuals who consume fatty foods are more likely to experience elevated cholesterol levels. Increased fat intake leads to elevated total cholesterol levels. This occurs because the fats in food, primarily triglycerides, undergo hydrolysis to form glycerol and fatty acids. To produce energy, these fatty acids undergo oxidation to form acetyl-CoA, a compound that is subsequently converted into cholesterol (Zou et al., 2026).

In addition to age and dietary habits, another factor influencing the respondents' high blood cholesterol levels is their exercise habits. The study results indicate that the majority of respondents (46.96%) rarely engage in physical activity, with exercise frequency of less than 3 times per week. The study by Sari et al. (2024) found a significant association between physical activity and total cholesterol levels ($P = 0.002$), with lower physical activity associated with elevated cholesterol levels. This is because reduced physical activity reduces fat burning, thereby contributing to higher total cholesterol levels. To maintain normal cholesterol levels, women need at least 1,500–1,700 calories, while men need at least 2,000–2,500 calories. Engaging in sufficient, routine physical activity can increase fat burning, helping lower total cholesterol in the blood (Chomiuk et al., 2024).

Table 2 shows that cholesterol levels in the control and intervention groups were still predominantly in the very high category at the second measurement (post), with a greater increase observed in the intervention group. This is supported by the Mann-Whitney test, which showed no significant difference in cholesterol levels between the control and intervention groups. This implies that administering 2 × 20 ml of VCO over 14 days did not significantly reduce total cholesterol levels in patients with hypercholesterolemia in Padukuhan Tegalsari, Pakembinagun, Yogyakarta.

These findings differ from those reported, demonstrating that administering 2 × 20 ml of VCO over two weeks significantly increased HDL-C levels by 10.45%. Furthermore, that study also indicated that VCO administration significantly increased HDL-C levels in younger participants (Mansouri et al., 2024). Theoretically, VCO has a positive effect on lipid profiles; its polyphenol content acts as an antioxidant that can prevent LDL oxidation (Nevin & Rajamohan, 2004). Furthermore, the medium-chain fatty acids in VCO can enhance fat oxidation and act as ligands for peroxisome proliferator-activated receptors (PPARs), thereby increasing HDL levels by increasing ABCA-1 expression. However, the results of this study did not demonstrate such positive effects. This is likely due to several factors, including respondents' age and gender, as well as lifestyle factors such as a high-fat diet and a lack of physical activity.

As we age, the function of LDL receptors declines, which helps inhibit cholesterol synthesis. A decrease in LDL receptor activity increases cholesterol synthesis, leading to elevated blood cholesterol levels (Solanelles Curco et al., 2025). Additionally, hormonal factors influence cholesterol levels; postmenopausal women experience a decline in estrogen, a hormone that increases HDL and lowers LDL (Rong et al., 2025). This decrease in estrogen leads to an increase in blood cholesterol levels (Matos-Silva et al., 2025). Another factor that may influence the study results is uncontrolled dietary patterns during the intervention. Consuming foods high in saturated fat is known to raise blood cholesterol levels (Ahanchi et al., 2024). Therefore, variations in participants' dietary patterns may introduce bias into this study.

This study has several limitations that need to be noted. First, this study used total cholesterol as the primary outcome, whereas previous studies typically used HDL. This difference in parameters may affect the sensitivity in detecting the effects of VCO administration on the lipid profile. Therefore, the non-significant results in this study do not directly indicate that VCO does not affect all components of the lipid profile. Second, this study did not strictly control the respondents' dietary patterns and physical activity. A portion of the respondents consumed fried foods daily (46.96%), and a portion had low physical activity levels (46.96%). These conditions could serve as confounding factors affecting the participants' cholesterol levels. Third, this study involved participants who were predominantly elderly (89.4%); this characteristic influenced responses to the VCO intervention, as the elderly experience declines in lipid metabolism and hormonal changes. The duration of the intervention in this study was relatively short, at 14 days. This duration may not have been sufficient to produce a significant change in cholesterol levels; therefore, studies with a longer intervention period are required to evaluate the effectiveness of VCO more comprehensively.

Recommendations for Future Research

Future researchers should avoid taking measurements immediately on the first day after the intervention ends. Researchers need to allow for a washout period following the intervention so that VCO has sufficient time to be metabolized in the body, thereby ensuring that the measurement results more accurately reflect the actual physiological effects. Additionally, future researchers need to more strictly control participants' dietary patterns and physical activity to minimize confounding factors. Future studies are also advised to use a larger sample and a more balanced age distribution to enable broader generalisation of the research findings. Future researchers should measure lipid profile parameters more comprehensively, including HDL, LDL, and triglycerides, to provide a clearer picture of VCO's effects on lipid metabolism. Furthermore, researchers are advised to use a Randomized Controlled Trial (RCT) design to enhance the validity and strength of the research evidence. Furthermore, it is recommended that future studies employ a longer intervention period (e.g. 1–3 months) so that changes in lipid profiles resulting from VCO administration can be observed more effectively.

CONCLUSION

This study aimed to evaluate the effect of Virgin Coconut Oil (VCO) administration on total cholesterol levels among patients with hypercholesterolemia in Padukuhan Tegalsari, Pakembinangun, Yogyakarta. The findings demonstrated that administration of VCO at a dose of 2 × 20 mL daily for 14 consecutive days did not produce a statistically significant reduction in total cholesterol levels compared with the control group. Most respondents remained in the very high cholesterol category after the intervention period, indicating that short-term VCO supplementation alone was insufficient to improve lipid status.

The results also suggest that demographic and lifestyle-related factors, including older age, frequent consumption of fried foods, and limited physical activity, may have contributed more strongly to persistent hypercholesterolemia than the intervention itself. These findings highlight the importance of comprehensive cholesterol management strategies that integrate nutritional counseling, routine physical activity, weight management, and periodic lipid monitoring. Healthcare providers and community-based health programs should prioritize evidence-based lifestyle interventions alongside complementary therapies to improve cardiovascular risk prevention. Future studies using randomized controlled trial designs, longer intervention periods, and comprehensive lipid profile measurements are recommended to strengthen the evidence regarding the effectiveness of VCO in lipid management.

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Conflict of Interest
The authors declare that there are no conflicts of interest in this study.

Authors' Contributions
Fransisca Anjar Rina Setyani: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft, Project Administration, Correspondence.
Chatarina Setya Widyastuti: Supervision, Validation, Methodology, Writing – Review & Editing, Resources.
Hiasinta Anastasia Purnawijayanti: Investigation, Data Curation, Visualization, Literature Review, Writing – Review & Editing.
All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Declaration of Generative AI Use
During the preparation of this manuscript, the authors used ChatGPT for language refinement and grammar improvement, DeepL for translation assistance, and AI-assisted tools to help identify relevant scientific literature. All outputs were carefully reviewed, verified, and edited by the authors. The authors take full responsibility for the accuracy, integrity, and final content of this manuscript.

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